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VI.

INJURIOUS INSECTS AND OTHER ANIMALS OBSERVED IN IRELAND DURING THE YEAR 1912.

By GEORGE H. CARPENTER, B.SC., LOND.; M.R.I.A.; F.E.S.; Professor of Zoology in the Royal College of Science for Ireland; President of the Association of Economic Biologists; and Consulting Entomologist to the Royal Dublin Society.

(Plates X. and XI.)

[Read June 24; Published August 11, 1913.]

CORN AND GRASS PESTS.

The Stem Eelworm.

Tylenchus devastatrix Kühn.

Samples of oats, with the characteristic "tulip-root" appearance due to the presence of these minute worms, were received in July from the neighbourhood of Belfast. It was stated that the crop promised to bear only half the normal amount on account of the damage done by the worms, an illustrated account of which has already appeared in this series (5, pp. 285–8).

The Cockchafer and the Garden Chafer.

Melolontha vulgaris (Linn.) and *Phyllopertha horticola* (Linn.).

Grubs of the latter well-known beetle (see 5, pp. 262–3; 6, p. 39) were received in September from Co. Galway. They had been feeding on roots of grasses in an old (twenty-year) meadow, and it was mentioned that, in that locality, these grubs do the greatest damage to "second grass." Rooks were observed to pull up the dead plants in order to get at the grubs. Larvae of the Cockchafer came from Co. Cork in May.

Chafers of these and allied species are, in certain seasons, especially numerous and destructive in the western counties of Ireland. The beetles are voracious devourers of leaves, while the

grubs feed on roots. Members of the family (Scarabaeidae) to which they belong are easily recognized by the flattening of the terminal segments of the feeler into plate- or leaf-like structures, especially

Fig. 1.—(*a*) Cockchafer (*Melolontha vulgaris*); (*b*) larva; (*c*) pupa. Natural size. From Ormerod's "Reports."

prominent in the male (see fig. 1*a*). *Phyllopertha horticola*, the "Garden Chafer" (fig. 2*a*), is one of the commonest members of the group. It measures about 8 mm. ($\frac{1}{3}$ inch) in length, and may be easily recognized by its metallic green head and fore-body, and its brown elytra or wing-covers (in reality the modified forewings). In this insect, as among chafers generally, the hind-wings are well developed, so that the beetles are able to fly. The Cockchafer is a larger and heavier insect, 25 mm. (1 inch) long, with blackish head and thorax, and brown wing-cases.

Fig. 2.—(*a*) Garden Chafer (*Phyllopertha horticola*); (*b*) larva. Magnified 3 times.

The larva of the Garden Chafer (fig. 2*b*), like the larger grub of the Cockchafer (fig. 1*b*), has a hard brown head and a cylindrical body, with somewhat soft and flexible cuticle. The three segments of the fore-body (thorax) carry each a pair of rather long jointed

legs. The mandibles have prominent apical teeth, and grinding surfaces at the base. On the middle of the hinder face of the mandible is a ridged area (fig. 3*b*), over which a process on the maxilla works so as to produce a shrill sound. On the mandible of the larva of the allied Cockchafer, this "stridulating" area differs in nature and position, being granulated, and close to the outer edge of the mandible (fig. 3*a*). A more easily seen distinction between the grubs is furnished by the claws of the feet; in the Cockchafer larva these are longest on the front pair of legs, and in the Garden Chafer grub on the hindermost pair.

Fig. 3.—Mandibles of Melolontha larva (*a*), and of Phyllopertha larva (*b*), showing rasping areas on hinder surfaces. Magnified 6 and 10 times respectively.

The larval life of the Garden Chafer lasts a year, and the beetles are on the wing about midsummer, when they often fly in swarms in bright sunshine. The Cockchafer, on the other hand, flies in the evening, and is sluggish during the day; its larva takes three or four years to become fully grown. The beetles may be collected in numbers by shaking them off trees and bushes where they rest—Cockchafers in the daytime, and Garden Chafers in the evening. Top-dressing land infested with the grubs of Chafers with gas-lime or kainit has been recommended (2. no. 25). These grubs are devoured greedily by rooks, lapwings, gulls, poultry, and pigs.

The Frit Fly.

Oscinis frit (Linn.).

Injury to oats and wheat by the maggots of this little black fly has been recorded on two occasions in this series of papers (5, pp. 147-8; 6, p. 8) from localities in Queen's County. In September, 1912, specimens were received from Co. Dublin; doubtless the insect is constantly present, though often overlooked.

CABBAGE AND TURNIP INSECTS.

The Root-Gall Weevil.

Ceuthorrhynchus pleurostigma, Marsh.

Turnips with the sub-globular galls due to the maggots of this beetle were received in March from Co. Galway, and in April from the neighbourhood of Belfast. An account of the insect and its life-history has already been given (5, pp. 425–7).

A Stem-boring Weevil Grub.

(?) *Baris* sp.

In the month of June cabbage and cauliflower plants were received from Co. Clare, the stem bored by a somewhat large grub, recognizable by its hard head, soft body-cuticle, and the want of legs, as belonging to the family of the Weevils (Curculionidae). The activity of the grubs within the stem leads to the breaking down of the tissues, and ultimately to the death of the plant. No measure of prevention except the removal and burning of the infested plants can be recommended in such a case as this. Attempts to rear the insect to its perfect condition in the laboratory were, unfortunately, not successful; and the identity of this pest must, for the present, remain doubtful. In 1893, Ormerod (12, pp. 23–5) recorded a very similar attack on cabbages from Co. Wexford, and suggested that the habits of the larva resembled those of *Baridius picinius*, Germ., as described by Taschenberg in Germany. In Fowler's work on British and Irish Beetles (7, vol. v., p. 380), this species appears as *Baris laticollis*, Marsh, which is a rare insect in the south of England, and is, so far, unknown in this country.

POTATO INSECTS.

The Potato-leaf Beetle.

Psylliodes affinis (Payk.).

These small beetles, allies of the notorious "Turnip Fly," eat the leaves of potato plants in spring and early summer. In May, 1912, specimens were received from Co. Tipperary and from

Co. Kerry. In the latter locality they were eating the leaves, not of potatoes, but of tomatoes. A description and figure of the insect have already been given (5, pp. 254–5).

FLAX INSECTS.

The Flax Flea-Beetle.

Longitarsus ater (Fab.).

This insect, like the last-mentioned, also resembles the "Turnip Fly" in structure and habits; but its ravages are especially noticeable on the flax-crop. A description and figure have already appeared in this series (5, pp. 152–3). In May, 1912, reports from different parts of Ulster showed that these small beetles were unusually numerous and destructive, probably as a result of the hot and dry summer of 1911. Dr. J. H. Hinchcliff, of the Department of Agriculture, informed me that in a field near Coleraine he noticed that there were patches of a yard square in which not a single plant had been left. In places in Co. Antrim the crop had to be re-sown. Near Limavady early-sown fields suffered serious damage, while those sown later escaped attack altogether. Spraying with lead arsenate might be tried against these beetles with much hope of success.

CELERY AND CARROT PESTS.

White Worms.

Enchytraeus albidus, Henle.

Specimens of small white annelid worms of the family Enchytraeidae were received from Co. Monaghan in February, with the statement that they were injuring celery, carrots, and parsnips, and also onions. Mr. R. Southern, of the Fisheries Office, kindly identified the species as *Enchytraeus albidus*, Henle, which is very common in farmyard manure, and thus gets conveyed into cultivated soil.

The Carrot fly.

Psila rosae (Fab.).

This familiar insect has already been described and figured in these volumes (5, pp. 255–7). In February, 1912, celery roots,

tunnelled by its maggots, were received from Co. Down, affording an illustration of how the larvae continue to feed throughout a mild winter.

ORCHARD INSECTS.

Reference has been made above (p. 83) to the excessive abundance of some species of insects in the spring of 1912, on account of the exceptionally hot and dry summer of 1911. This feature was more especially noticeable among caterpillars and aphids and allied suckers which infest fruit trees and bushes. The increased insect population of the summer and autumn of 1911 naturally produced an abnormally large number of winter-eggs, or other hibernating stages, and the result was, in some localities, a veritable plague of insects during the spring of 1912, when the weather also was unusually dry. The much-abused heavy rains that fell during June, July, and August, 1912, were probably distinctly beneficial in killing off multitudes of these destructive species.

On 29th May one sample of apple-shoots, sent from Portadown, was found to be infested with two kinds of Aphid—*A. pomi* and *A. sorbi*—the Apple-sucker (*Psylla mali*), and caterpillars of the Winter-moth (*Cheimatobia brumata*) and of a species of Tortrix.

The Apple Aphids.

Aphis pomi, De Geer, and *A. sorbi*, Kalt.

As mentioned above, apple-shoots infested with these two species were received from Portadown at the end of May. In June and July came specimens of *A. pomi* from Co. Waterford and Co. Tipperary, and in May and June *A. sorbi* from Co. Antrim, Co. Waterford, and Co. Dublin. In every case the number of specimens on the trees was exceptionally large, and the damage to the foliage very great.

An account of the life-cycle of *A. pomi*, with figures, has lately been given in this series (6, pp. 12–15). The various forms of *A. pomi* are green or yellow and black in colour; in *A. sorbi* the virgin spring and summer females are reddish or purple, with a whitish powdery covering, with the legs and feelers mostly black,

hence it is known as the "Rosy Apple Aphid." Among the samples received in June, both winged and wingless virgin females were present. While in *A. pomi* the winged females go to other apple-trees, the corresponding forms of *A. sorbi* migrate away from the apple altogether, and it is believed that the late summer generations of the species live on grasses. Winged autumn migrants come back to the apple-trees at the fall of the year, and bring forth small wingless egg-laying females, like those of *A. pomi*, and males, which, unlike those of *A. pomi*, are winged. The winged summer migrants of *A. sorbi* have shining black thorax and yellowish-red abdomen. The autumn migrants, which come back to the apple-trees, are darker in aspect, having a large black central patch, and marginal spots on the reddish or brown abdomen. The winged male resembles the autumn migrant, but his body is narrower, and his abdomen less heavily marked with black.

The Woolly Aphid.

Schizoneura lanigera (Hausm.).

The white woolly appearance of the bark of apple trunks and branches, due to the presence of this insect—the so-called "American Blight"—is too familiar in old orchards. In July, 1912, an especially badly infested apple-shoot was received from Co. Limerick. As some recent researches have thrown new light on the life-history of this common pest, a summary of our knowledge of it may be acceptable here. Although the insect was first described (1802) from Germany, it is possible that the name "American Blight" truly indicates its place of origin, though many American naturalists stoutly deny this. However, it is to entomologists of the United States that we owe most of our knowledge of the species, and, among recent writings, the papers of Alwood (1), Marlatt (11), Stedman (17), and especially Miss Patch (13) are noteworthy.

The genus Schizoneura, to which the Woolly Aphid belongs, falls into a sub-family distinct from Aphis and its allies, being characterized by the absence of the projecting cornicles on the abdomen which are so conspicuous in an ordinary "green-fly";

to the same sub-family belongs the notorious Phylloxera of the vine. The best-known forms in the life-cycle of Schizoneura are the wingless virgin females which infest the bark of the apple trunks and shoots during the spring and summer months, and, to some extent, at least in mild winters, throughout the year. These are small, brown insects, about 3 mm. ($\frac{1}{8}$ inch) long with relatively short feelers, and producing from the abdomen a large quantity of white waxy threads, which cause the well-known woolly appearance of the bark where a multitude of these creatures are crowded together. These virgin, wingless females (fig. 4, *b*) are provided with needle-like piercers, especially long and formidable in the young (fig. 4, *c*); by means of these they bore into the bark and suck the sap. Through the summer there are several successive generations of these wingless females; their waxy covering serves

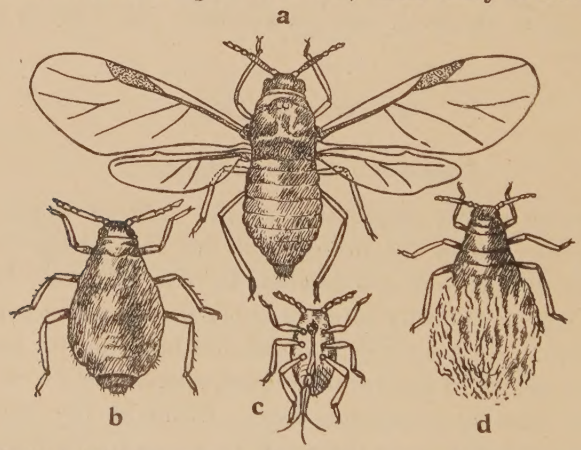

Fig. 4.—Woolly Aphid (*Schizoneura lanigera*); (*a*) winged virgin female; (*b*) wingless virgin female; (*c*) young; (*d*) wingless female with woolly secretion. Magnified 10 times. After Marlatt. Entom. Circular 20, U. S. Dept. Agric.

as a protection, and is also believed to facilitate their transport from tree to tree through the agency of wind. In autumn these wingless females may give birth to young which acquire wing-rudiments, and ultimately become winged virgin females (fig. 4, *a*), whose power of flight enables them to migrate; these winged forms have rather long feelers, and their waxy covering is but feebly developed.

An interesting feature in the life-cycle of this insect is found

in the various ways in which it can pass the winter. On account of their habit of sheltering in cracks of the bark, the generations of wingless virgin females are often continued all through the year, young individuals surviving unharmed through the colder months. This occurs, according to Marlatt, in the Southern States of North America, and it is certainly common through the mild winters of our country. An unsuspected winter shelter for these wingless forms has lately been discovered by Hewitt (8), who found them within the cores of pippin apples, imported from America and sold in the Dublin markets. In this particular type of apple there is an open, though very narrow, channel leading from the "eye" at the calyx end of the fruit into the core; along this channel the insects had made their way, and colonies might thus be carried from place to place.

Another adaptation for wintering is furnished by colonies of wingless virgin females on the roots. The members of these, like those of the branches, are covered with a waxy secretion (fig. 4, d_1), and their presence causes the growth of gall-like swellings on the roots. In America, these subterranean colonies—which, though

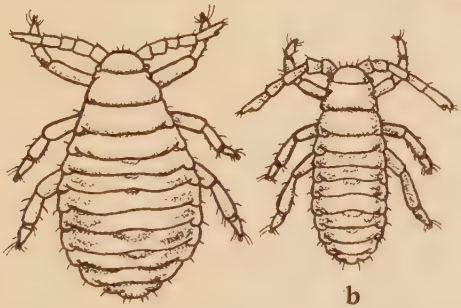

Fig. 5.—Woolly Aphid (*Schizoneura lanigera*); (*a*) egg-laying female; (*b*) male. Magnified 35 times. After Alwood, Virginia Exp. Sta. Bulletin, 1904.

primarily for hibernation, often persist through the year—are considered much more harmful than the aerial insects on the trunk and branches. In these countries, however, there is often serious damage to the bark of shoots; unsightly cracks appear through which the spores of the canker-fungus Nectria can enter the tree, and deformed swellings are apparent on the twigs.

The third possible method of hibernation is by means of

winter-eggs. The winged virgin females, mentioned above, which migrate in autumn, give birth to the sexual forms—males and egg-laying females. These in Schizoneura are exceedingly minute, the female (fig. 5, *a*) being only 1 mm. ($\frac{1}{23}$ inch) long, and the male (fig. 5, *b*) smaller still. Both sexes are wingless, and with the jaws mere vestiges, so that they cannot feed. After pairing, the female lays a single, relatively large, egg in a deep crevice of the bark, where it remains through the winter, to give rise in the next spring to a "stem-mother," or foundress of the virgin female broods.

Very few entomologists have ever seen these sexual forms, and there are but scanty records of their occurrence on apple-trees. Theobald, for example, states (18, p. 147) that in Kent he has observed the egg-laying female but twice in twelve years. Perhaps the power which the virgin females possess, of surviving the winter in the bark or on the roots, makes the winter eggs needless, so that the species tends to become entirely parthenogenetic. In America, however, Miss Patch's recent work (13) establishes the fact that the normal host-plant for the sexual forms and early spring "stem-mothers" of *Schizoneura lanigera* is the elm, on which they have been known for forty years as *S. ulmi*, or *S. americana*. The stem-mothers and their offspring on elm in the spring cause "leaf-curl." The third generation are winged forms which may migrate to apple or rowan, and give rise to the summer brood of Woolly Aphid on the bark. The autumn virgin winged females, mentioned above, migrate to the elm late in the year, and give birth there to the sexual forms which produce the winter eggs.

Miss Patch's observations suggest strongly that the periodic migration between elm and rosaceous trees is the normal life-cycle for this species. It may be doubted, however, if it is the usual life-cycle, even in America. Riley observed seven summer generations on the bark of elm, and the sexual forms may occur, rarely at least, on apple. Probably a species originally migratory, with two alternate hosts, is now differentiating into two distinct races. It is to be hoped that we may establish in this country whether the elm can be infected from the apple, or the latter from the elm. According to most special students of

the Aphidæ, the European insect which causes "leaf-curl" (*Schizoneura ulmi*) is specifically distinct from the transatlantic form (*S. americana*, Riley), and has *S. fodiens*, Buckton, as an underground alternating race feeding on the roots of various herbaceous plants. *S. fodiens*, according to Theobald (18, p. 149), though sometimes found on apple-roots, is distinct from the root-feeding form of *S. lanigera*. Thus there are still some interesting questions to be cleared up as to the relationship of these Schizoneurae.

For killing the colonies on the trunk and branches, spraying with quassia wash or paraffin emulsion is effective; where the trees are not high nor numerous, the wash may be advantageously applied with a soft brush. Winter spraying with caustic alkali wash is a valuable preventive measure, as it clears away lichens and similar growth which serve as shelter to the aphids. The root-dwelling colonies are best destroyed by the injection of carbon bisulphide into the soil; a fluid ounce is enough for a good-sized tree. Above all, the introduction of this pest in nursery stock should be rigorously guarded against by careful inspection before planting. Some birds, especially Blue Tits, devour large numbers of the Woolly Aphid, and deserve to be protected by fruit-growers.

The Cherry Aphid.

Myzus cerasi (Fab.).

Cherry leaves were received early in June from a Dublin suburb, infested with this black aphid, which was recently described and figured in this series (6, pp. 16–17).

The Currant Aphid.

Rhopalosiphum ribis (Linn.).

This species has also been described and figured in the present volume (6, pp. 15–16). During June and July, 1911, it was forwarded on shoots of currant and gooseberry bushes from Cos. Antrim, Waterford, and Donegal. A notable and cheering feature was the large proportion of the aphids that had been

parasitized by a small ichneumon-fly, which lays her egg within the aphid, so that the grub may devour it internally. Aphids that have been thus killed present a hard, brown empty cuticle pierced by a small circular hole through which the fly has emerged after completing its transformations.

The Apple Sucker.

Psylla mali (Schmidb.).

A vast amount of damage was done to apple-blossoms in May, 1912, by the larvae and nymphs of this little insect, already described at some length and figured in this series (5, pp. 595-9). Specimens of shrivelled buds containing the insects were received from Cos. Dublin, Kerry, Armagh, and Tyrone. In some cases the conspicuous hairy, black fly, *Bibio marci*, was noticed in numbers around the injured blossoms, and was wrongfully accused of causing the damage, though not unnaturally, as the young Psyllae, lurking within the shrivelled petals, are minute and not easily seen.

The Ruddy Shield-Bug.

Acanthosoma haemorrhoidale (Linn.).

Specimens of this handsome bug were sent in February, 1912, from Co. Cork, with the information that they were sucking the buds of apple-trees, then, of course, unopened. In my last year's paper (6, pp. 64-6) an account was given of *Lygus pabulinus* as injurious to rose trees.[1] Acanthosoma belongs to the same division of the Hemiptera as Lygus, but to a different family—the Pentatomidae or Shield-bugs, usually recognizable by the flattened form and very large scutellum. The species of Acanthosoma have the foot with only two segments (in the Pentatomidae there are generally three), while the abdomen has the ventral keel prolonged into a prominent spine on the second

[1] I notice that in Reh's zoological contribution to Sorauer's "Handbuch der Pflanzenkrankheiten" (vol. iii, pp. 628-9) records are given of injury by this species to potatoes and various garden plants in Sweden, Holland, and Germany.

segment. *A. haemorrhoidale* (fig. 6) has the angles of the prothorax produced; it is a large bug, about 15 mm. ($\frac{5}{8}$ inch) long, of a shining green colour, with reddish marking (Saunders,

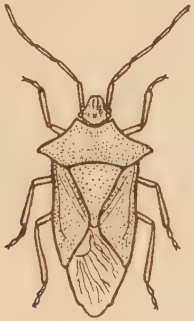

Fig. 6.—Shield-bug (*Acanthosoma haemorrhoidale*). Magnified 3 times.

15, pp. 37–9). Probably damage by these insects is exceptional, and shaking them off the trees on to sheets, or into vessels of liquid, would prove an effective remedy. Schoyen (16, p. 41) mentions this species as harmful to Syringa in Norway in 1897.

The Clay Vine Weevil.

Otiorrhynchus picipes (Fab.).

Early in June Mr. A. Fiske of Rathfarnham sent specimens of the "Clay Vine Weevil," with the information that the insects were causing great damage to young black-currant bushes, by eating away all the foliage, and sometimes devouring entire shoots. As is the usual habit of these weevils, they committed their depredations after dark. An illustrated account will be found in an earlier paper of this series (5, pp. 579–581). In May, 1912, the root-feeding grubs of Otiorrhynchus were received from Co. Antrim, with the information that they were attacking all kinds of garden plants.

Leaf Weevils.

Phyllobius oblongus (Linn.) and *P. viridiaeris*, Laich.

An account of the former of these two species has been given earlier in the current volume (6, pp. 39–40). In May, 1912,

specimens of it were received from Dundalk with the statement that they were devouring the growing shoots of apple trees. During the same month specimens of the second species (*P. viridiaeris*) were received from Co. Antrim, where they were devouring apple foliage. The weevils were very numerous, and were evidently causing great damage. This is one of several species of Phyllobius distinguished from *P. oblongus* by the untoothed thighs, and by having the body covered with bright-green metallic scales. Its habits resemble those of *P. oblongus*, and it may be attacked by the cultivator in the same way as that species.

The Winter Moth.

Cheimatobia brumata (Linn.).

Caterpillars of this well-known insect (see 5, pp. 329–331, 434–5) were very abundant during May, 1912, feeding on the leaves of apple and other trees in many parts of the country. In Co. Tyrone they ate the foliage of black-currant bushes, and in Co. Antrim they attacked plum, currant, and gooseberry. When feeding on the last-named crop, they bit holes in the young fruits, and devoured unopened buds.

The Small Ermine Moth.

Hyponomeuta malinella, Zell.

Apple-shoots disfigured by the webs spun by societies of these caterpillars were received in April and May from two localities in Co. Dublin. The insect has been already described (5, pp. 436–7).

The Codling Moth.

Carpocapsa pomonella (Linn.).

Apples bored by the caterpillars of this moth came from Co. Clare in June. The insect has been described and figured in the current volume (6, pp. 40–44, pls. vi, vii).

The Common Bell Moth.

Tortrix ribeana (Hub.).

Apple-shoots, with caterpillars of this moth eating the leaves, were found in May in two localities in Co. Dublin. The caterpillar

is olive green in colour, with blackish head and a black dorsal plate on the front thoracic segment; the other segments of the body have black spots, bearing bristles. This caterpillar measures about 16 mm. ($\frac{2}{3}$ inch) in length; like most Tortrix larvae, it is very active and irritable, twisting and wriggling when disturbed, though it is usually hidden among the leaves, which it fastens together by means of its silken threads. It feeds during May and June, becoming fully fed about midsummer, when it pupates in its shelter of leaves and silken web. The moths are flying in July; the forewings are pale, yellowish brown, with dark brown wavy bands and spots. After pairing, the female lays her eggs, which are the wintering stage for the species.

For the destruction of these caterpillars Theobald (18, p. 81) recommends early spraying in April with lead arsenate wash before the caterpillars have been able to do much damage; a second application of the wash in May is sometimes advisable.

The Pith Moth.

Blastodacna vinolentella, Schäff.

This insect (see 5, pp. 333–4, 576) was again noticed in Co. Dublin, the caterpillar feeding as usual in the spring in the centre of apple-twigs.

The Apple Sawfly.

Hoplocampa testudinea, Klug.

(Plate X., A, B, C.)

Though the presence of this insect as an orchard pest in Ireland had often been mentioned to me, I never saw specimens of the caterpillars until June, 1912, when damaged apples, with the insects feeding inside, were received from Cos. Tyrone, Tipperary, and Kildare. It was stated that in Co. Tyrone the damage had been noticed also in 1910 and 1911, the variety of apple affected being "Worcester Pearmain."

It is believed that the caterpillars of this sawfly are often confused with those of the Codling Moth (see 6, pp. 40–44). The appearance of the injured fruits differs, however, in the two cases.

The larva of Hoplocampa eats out a large central cavity (Plate X., A, C.) in the apple, but before boring into the soft tissue the insect often forms a narrow, almost straight track along the surface (Plate X., B). It eats its way out through a circular hole. Frequently a caterpillar leaves one fruit to enter another, and two may be found feeding within the same apple.

A good account of the apple sawfly is given by Theobald (18, pp. 122–126). The adult insects fly in April and May; the female (fig. 7 *a*) is reddish-yellow, with spots on the head and thorax, and the dorsal surface of the abdomen blackish, and measures 6–8 mm. ($\frac{1}{4}$–$\frac{1}{3}$ inch) in length. She lays her eggs in the stalks of the blossoms, just below the calyx, cutting for each egg an incision with her saw-like ovipositor. After a week or a fortnight the larvae are hatched; the larva is a soft, whitish

Fig. 7.—(*a*) Apple Sawfly (*Hoplocampa testudinea*); (*b*) caterpillar, twice natural size; (*c*) injured apple with caterpillars, natural size. From Ormerod's "Reports." (*a*) and (*b*) after Westwood.

caterpillar with dark-brown head, and a black plate on the hindermost abdominal segment, with three pairs of legs on the thorax and seven pairs of prolegs on the abdomen (fig. 7 *b*). (It should be generally known that, while the caterpillars of our native moths and butterflies have five or fewer pairs of abdominal prolegs with hooks, the larvae of sawflies have six or more pairs of prolegs without hooks.) The caterpillars of Hoplocampa eat their way into the apple, which they injure as already described; in four or five weeks they are fully grown, having attained a length of about 12 mm. ($\frac{1}{2}$ inch). They then leave the fruits, fall to the ground, and, burying themselves, spin silken cocoons

within which they change to pupae after an interval of a week or more. The pupal stage may last for nearly a month, and a second brood of flies appears in July, whose offspring feed as caterpillars within the larger apples during that month, and in August. These, when fully grown, go underground, and spin cocoons; but, like other well-known sawfly larvae, such as the "Pear Slug" (*Eriocampa limacina*) and the currant sawfly (*Nematus ribesii*), they remain unchanged through the winter, not pupating until the following spring.

Theobald (18, p. 126) states that digging-in kainit in early spring is sometimes effective against the hibernating larvae. Removal of the surface-soil, as with the currant sawfly, is advisable, but may prove impracticable in large orchards. "The best results have been obtained by injecting bisulphide of carbon into the soil, at the rate of 4 oz. to each tree in eight injections by means of the Vermorel injector." When the caterpillars are actually feeding in the fruits, nothing but hand-picking can be recommended.

The Pear and Black-currant Gall Mites.

Eriophyes pyri (Nal.) and *E. ribis* (Nal.).

These two pests have already been described and figured in this series (5, pp. 581–3 and 260–2). Leaves injured by the former were received from Co. Dublin in May, and the latter was reported from Co. Kerry in March.

The Plum Gall-mite.

Eriophyes similis (Nal.).

In June, Dr. G. H. Pethybridge received from Navan, Co. Meath, and handed to me, plum-leaves affected with galls, which agree with the description given by Kieffer (10, p. 399) of the work of this species; whitish or reddish swellings are arranged along the edges of the leaves, more rarely spread over the surface. These galls are hairy above, and show a median longitudinal depression, at the bottom of which is the opening into the cavity where the mites live and reproduce. According to Theobald (18, p. 399), the plum gall-mites winter under the bud-scale, where they may be checked by spraying with caustic and sulphur wash.

GARDEN INSECTS.

The Australian Fern-Weevil.

Syagrius intrudens, Waterh.

Ten years ago (5, pp. 204–7) this weevil was recorded as extremely destructive to ferns in the glass-houses at the Royal Botanic Gardens, Glasnevin. In June of last year Sir Frederick Moore forwarded beetles and larvae of the same species, which were feeding in the rhizomes of ferns grown out of doors, and had been doing so during the previous two years. This pest has thus become far too well acclimatized in Ireland, as the destruction of the insects in the open is, of course, much more difficult than in greenhouses.

The Turnip Moth.

Agrotis segetum, Schiff.

This common insect has been described and figured (5, pp. 432–4), and several times mentioned (5, p. 592 ; 6, p. 37), in this series of papers. In July, 1912, the caterpillar was received from a Co. Dublin garden, feeding in the bulb of a valuable Gladiolus whose leaves it had entirely destroyed.

The Primrose Fly.

Chilosia sparsa, Loew.

(Plate X., D.)

In the spring of 1911, I received from Miss Wynne, of Ovoca, Co. Wicklow, primrose plants in the bases of which maggots were boring. Examination of the maggots showed that they must belong to some fly of the family Syrphidae (Hover-flies), as they resembled the grub of the Narcissus-fly (see 6, pp. 69–71, fig. 12), with the tail spiracles on a prominent median process. The maggot is found in the upper part of the root and the thickened stem-region whence the leaves spring, eating out a considerable cavity, and often leading to the death of the plant. Further specimens were sent in May, 1912, but I failed in my attempt to rear the fly for identification. In June, 1912, Sir F. Moore sent me plants of *Primula pulverulenta*, which had been similarly injured,

and informed me that complaints of the ravages of this unknown insect had reached him from various parts of Ireland, and also from the south of England. In May of the present year (1913), Miss Wynne, who had kindly kept a plant in which a maggot was known to be feeding under cover for more than a year, secured a specimen of the fly, which proved to belong to *Chilosia sparsa*. So far, this fly does not seem to have been recognized as injurious, but Kaltenbach (9, pp. 325, 342, 378) records five species of Chilosia, whose larvae feed within the stems of composite plants.

As mentioned above, Chilosia belongs to the family of the Syrphidae, or Hover-flies, which contains the Narcissus-fly (Merodon). Merodon is allied to the Drone-flies, Eristalis, while Chilosia belongs to the section of the family which includes the Syrphi or true Hover-flies, which are beneficial, as their larvae feed on Aphids. In this Syrphine group, as Verrall points out (19, p. 134), the middle cross-nervure of the wing is nearer the base than among the Eristalines. The genus Chilosia contains a number of dark-brown, blue, or blackish flies, not bright or metallic in appearance like most Syrphines, and with distinct margins below the eyes. *C. sparsa* may be recognized by its bare eyes (without hairs), and black legs, and feelers; from its nearest ally, *C. antigua*, Meig., *C. sparsa* may be distinguished by the fine puncturation and even black hairs on the thorax, and the golden yellow pubescence of the abdomen, the second segment of which, in the male, has a strong tuft of black hairs on each side basally. The fly is 8 mm. ($\frac{1}{3}$ inch) long. (See Plate X., D, 1.)

The larva (Plate X., D, 2) is about 10 mm. ($\frac{2}{3}$ inch) long when fully grown. It has a whitish cuticle beset closely with rows of brownish spines, which assist it in moving about. The mouth hooks are distinctly ventral in position, and the tail-spiracles are situated at the end of a conspicuous terminal yellowish-brown median process, dorsal to which is an extensive smooth area belonging to the hindermost abdominal segment. The last larval cuticle hardens to form the abbreviated brown puparium (Plate X., D, 3) within which, buried in the soil, the fly completes its development.

With regard to the life-cycle of this fly, Miss Wynne has kindly informed me that the maggot may be found feeding in the plants as early as February and as late as September. Probably the pupal stage is normal for wintering, and the flies emerge in spring. It is regrettable that the habits of these maggots do not lend themselves to any method of attack by the gardener except the lifting and burning of badly infected plants.

OSIER INSECTS.

Green Willow Beetles.

Phyllodecta vulgatissima (Linn.) and *P. vitellinae* (Linn.).

Osier shoots eaten by these leaf-beetles and their larvae were received in May from Co. Antrim. An account of these insects, with illustration, has been given (5, pp. 449–450, 607).

The Yellow Willow Beetle.

Galerucella lineola (Fab.).

This species was present on the osier shoots just mentioned, in far larger numbers than the two species of Phyllodecta. In April the same species had been received from Co. Limerick, where it was eating young shoots of willows, and in June from Co. Kildare. In the two latter cases also, the insects were exceedingly numerous.

Galerucella belongs to a section of the leaf-beetles, or Chrysomelidae, which differs from that containing Phyllodecta by the attachment of the feelers close together at their bases, between the eyes, instead of on either side of the head. The species of Galerucella are usually yellow or brown in colour, and covered with fine, downy hairs (see Fowler (7), vol. iv., p. 329). *G. lineola* is a common insect on willows and other trees; it has the head short, the wing-cases rounded behind at the inner corner and the thorax thickly pubescent. It is somewhat narrow and elongate in form (fig. 8 *a*), with the outer sides of the wing-cases parallel, and is of a uniformly brownish-yellow colour above, except for black spots at the apex of each antennal segment, on the vertex of the

head and on the scutellum. The larva has a black head, and the cuticle of the thoracic segments above is mostly black, with a yellow median line. There are three pairs of short legs. The abdominal segments are yellow with regular series of black transverse markings and spots, which bear short, black hairs (fig. 8 *b*.) The young larva has a relatively larger area of the body pale, the insect, as it increases in size, displaying the black

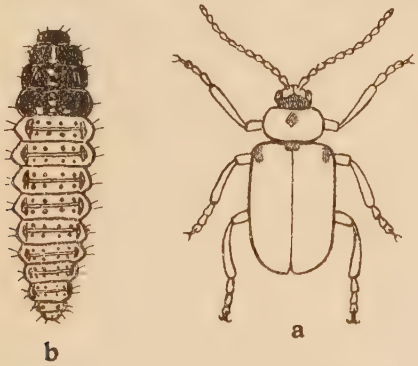

Fig. 8.—(*a*) Yellow Willow-beetle (*Galerucella lineola*); (*b*) larva. Magnified 5 times.

patches and bristles more strongly. The life-cycle and habits of these insects resemble those of Phyllodecta, and the same methods of destruction are applicable (5, p. 450), such as setting "traps" of heaps of osier peelings in autumn to afford winter shelter for the beetles (these to be gathered and burned before the spring) and spraying with lead arsenate wash when the beetles and their larvae are actually feeding in spring and summer.

FIR INSECTS.

The Fir-Bark Chermes.

Chermes piceae, Kalt.

(Plate XI.)

Bark of Silver Fir, suffering from a bad attack of this insect, was received from Co. Tyrone in November. In 1908 the species was found in Co. Wicklow (5, p. 607), and it is to be feared that

it may follow Silver Fir into fresh plantations. The trees attacked in Co. Tyrone had been planted only recently.

Attention has already been called to Burdon's valuable paper (4) on the European species of Chermes, in which the results of Cholodkowsky's researches are made available for English readers, and supplemented by Burdon's own observations. Recently Börner (3) has published a somewhat full monograph of the genus. It is now well known that in the typical life-cycle of a Chermes there are two host-trees, the Spruce being termed the "principal" host, as the sexual broods of Chermes live on it, and some other genus of conifer, on which live colonial virgin females, serving as an "intermediate" host. From this intermediate host a brood of winged virgin females, the "sexuaparae," migrate back to the Spruce. In *C. piceae* the development of sexual forms has, to a great extent, ceased, the only members of the species generally recognized being successive generations of wingless virgin females on the Silver Fir. Börner (3, pp. 138–143) distinguishes between a winter and a summer form of these females, all of which are covered with a thick waxy secretion, forming long threads, which give the well-known white cottony appearance to affected trees. Most of these insects are found on the shoots and twigs (Plate XI), but some of the summer forms congregate on the needles. The virgin reproduction of Chermes differs from that of the typical aphids in that eggs are always laid, and the young are hatched out of them, instead of being brought forth in an active state.

In Germany, Börner has discovered that some of the offspring of the winter forms develop wing-rudiments, and ultimately become winged "sexuaparous" females, which migrate to the Spruce, and there lay eggs. From analogy with the life-cycle in other species of Chermes it may be inferred that sexual insects—males and females—develop from these eggs. The subsequent generations, and their migration from Spruce to Silver Fir, have, as yet, however, not been traced, and a permanent attachment to trees of the latter group is probably now normal for this species.

The larvae and adults of *Chermes piceae* are dark-reddish or violet in colour, becoming nearly black as they grow old. The

larva has the body-segments covered with broad quadrangular chitinous plates, three on each segment on either side of the median line (fig. 9 *a*). In the adult the plates are relatively smaller, and more widely separated, and show the openings of the wax-secreting glands, arranged in clusters (fig. 9 *b*).

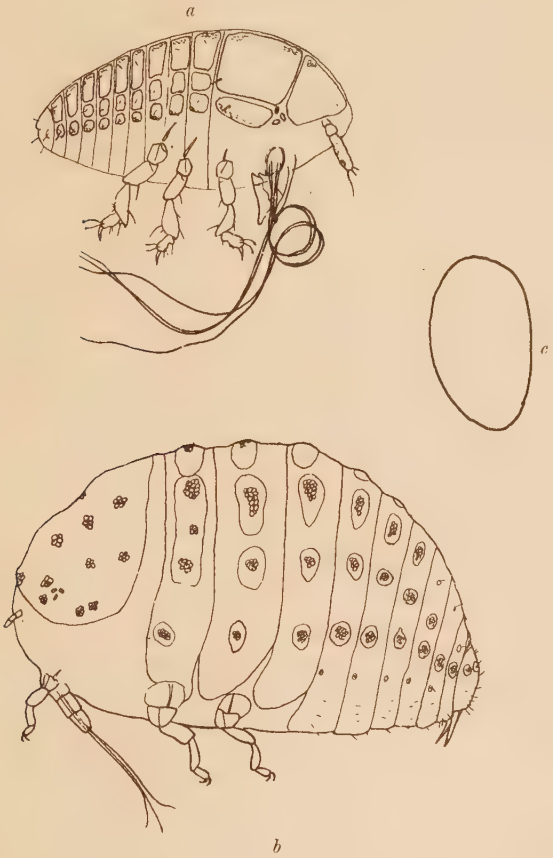

Fig. 9.—*Chermes piceae*, (*a*) larva; (*b*) virgin female, winter form; (*c*) egg. (*a*) is magnified 100 times; (*b*) and (*c*) 50 times.

In small and young plantations, spraying with paraffin emulsion should be tried as soon as Chermes are seen. In extensive woodlands, however, it is doubtful if spraying would be profitable.

STOREHOUSE INSECTS.

The Mediterranean Flour Moth.

Ephestia kuehniella, Zell.

A fairly full and illustrated account of this insect was given in an early paper of this series (5, pp. 209–214), as it proved a great pest in certain Belfast mills. No further complaints of the moth's presence in Ireland were received until November, 1912, when my friend Mr. R. Welch, of Belfast, detected its caterpillars in a flour-mill at Drogheda, and kindly forwarded specimens to me.

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EXPLANATION OF PLATE X.

A. B. C. Young Apples injured by caterpillars of the Sawfly, *Hoplocampa testudinea*. The middle figure shows the surface-track; the others the central cavity eaten out.

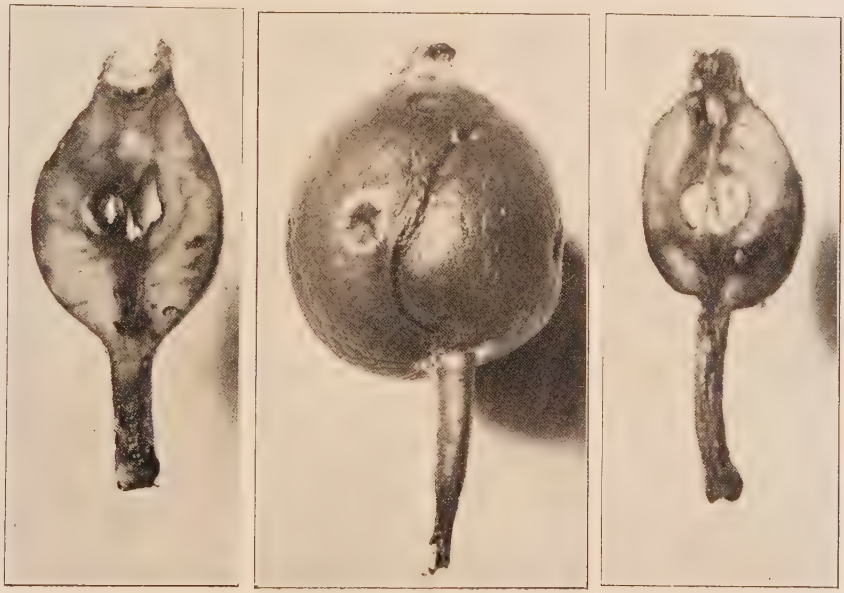
D. (1) Primula fly (*Chilosia sparsa*); (2) maggot, ventral view. (3) puparium cuticle. Magnified 3 times.

EXPLANATION OF PLATE XI.

Branch and twigs of Silver Fir infested with *Chermes piceae*.

Photographs by T. Price.

A B C



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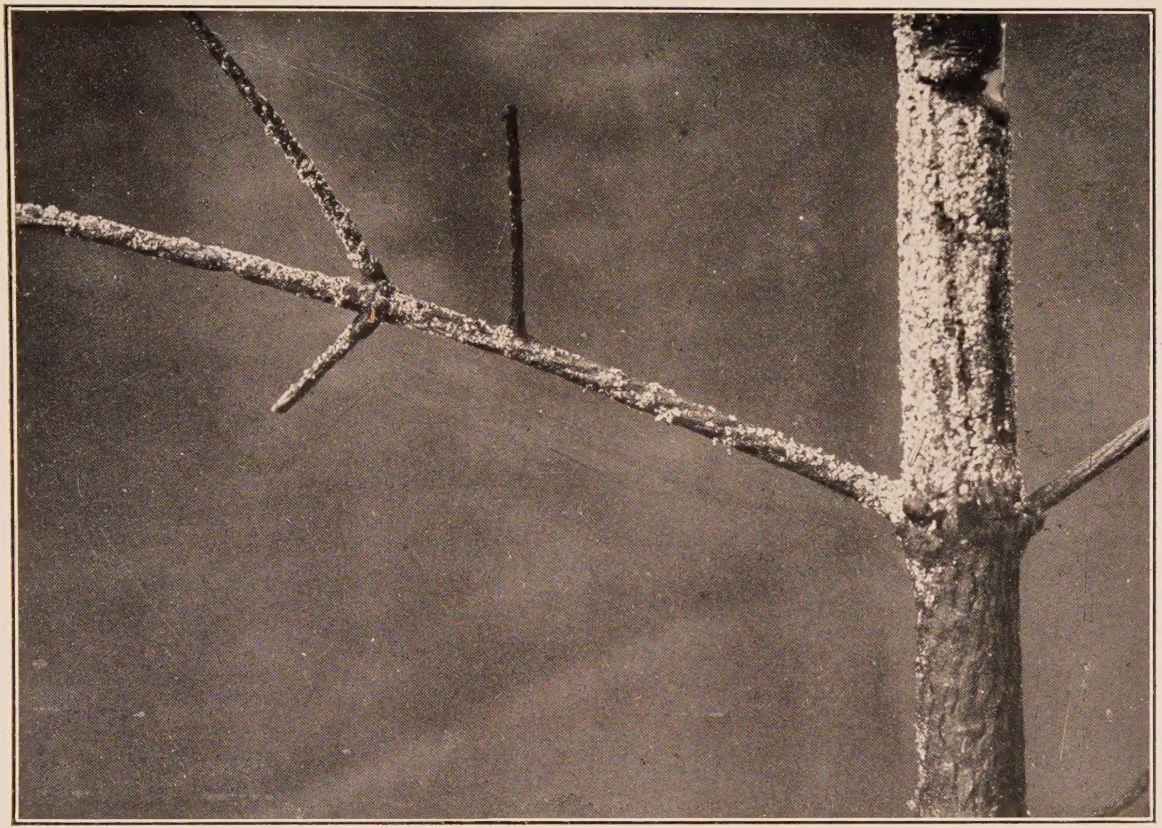

Silver Fir infested with *Chermes piceae*.

ECONOMIC PROCEEDINGS.

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No.

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